2022 年度
大学院理工学研究科【生命理学専攻】博士後期課程
一般選抜試験(第Ⅱ期)問題

英　　語

開始時刻　午前 10 時 00 分
終了時刻　午前 11 時 00 分

【注意事項】

１．解答用紙には受験番号、氏名を必ず記入してください。

２．配布された答案用紙は試験が終了したら、必ず提出してください（問題用紙は提出しなくてよい）。

３．問題番号が明記された答案用紙を使用し、解答してください。

問題 1　以下の文章を読んで、各設問に答えなさい。
Read the following text and answer each question.

Sleep

There are two types of sleep. One is (1) REM (rapid eye movement) sleep. This is a shallow sleep where the body is resting, but the brain is working, making it easier to wake up. During this time, the brain is fixing memories and organizing emotions. It is also during REM sleep that we dream. It is said that REM sleep increases when there is a lot of mental stress.
On the other hand, (2) non-REM (NREM: non-rapid eye movement) sleep is a deep sleep in which the brain is resting slowly and does not wake up easily. It is related to physical growth, tissue repair, and immune system maintenance. It is said that non-REM sleep increases when there is a lot of physical stress.
REM and non-REM sleep are both repeated several times a night. This allows both the body and the brain to rest, which is thought to help maintain physical and mental health.

(a) Sleep deprivation (lack of sleep) is a condition in which a person does not get the sleep they require due to having to stay awake. On the other hand, insomnia is a condition in which a person cannot obtain adequate sleep due to stress or other factors, despite being in a situation in which they can sleep.

Insomnia is a sleep disorder in which people have trouble obtaining adequate sleep. It leads to sluggishness and drowsiness interfering with daily life. On the other hand, if a person wakes up feeling refreshed and has no problems in everyday life, even if the sleep duration is short, it is not considered insomnia. Insomnia is classified based on the sleep-deprived period and is divided into the following categories: disturbance of falling asleep, midway awakening, disturbance of deep sleep, and early awakening.

[I] Difficulty falling asleep [Sleep onset insomnia]

This is a difficulty falling asleep even after getting into a bed and trying to sleep (taking 30 minutes to an hour or more before falling asleep) and it is easily triggered by worry or stress. However, once the person falls asleep, they can usually sleep until morning. This is the most common type of insomnia.

[II] Disorder of deep sleep

This is a type of insomnia in which the sleep is light, and the person does not feel well-rested after getting up, even if the person has supposedly had a sufficient amount of sleep. This is the most common type of insomnia among the elderly and nervous temperament people.

[III] Early morning awakening [Terminal (or Late) insomnia]

This is a type of insomnia in which a person wakes up early in the morning (around 3:00 to 4:00 a.m.) and cannot go back to sleep. This is the most common type of insomnia among depressed or older people.

[IV] Middle Awakening [Sleep maintenance insomnia]

This is a type of sleep disorder in which a patient wakes up several times during sleep. In most cases, the patient can go back to sleep but repeatedly wakes up during the night. As a result, the patient does not feel they slept enough.

These are the characteristics of insomnia. Insomnia causes a loss of the restful feeling associated with sleep, impairing not only daytime activities and their mental state but also their health, work efficiency, and quality of life. (b) Today, it is estimated that one in five people in Japan has insomnia. It is also said that the rate of insomnia increases with age.

After experiencing a stressful event, many people experience temporary insomnia that persists for a few days to a few weeks. However, insomnia persists for more than a month in a few individuals. Insomnia can

be caused by stress alone or be associated with other illnesses (mental or physical). There is no single reason for insomnia in many cases, and instead there is a combination of reasons. For example, it is known that patients with some diseases are more prone to insomnia. In hypertension, the sympathetic nervous system (which activates various bodily functions) is excited, preventing sleep. In the case of diabetes, numbness and pain due to nerve damage from complications such as frequent urination and heavy water consumption associated with high blood glucose can interfere with sleep. Obesity and metabolic syndrome also increase the frequency of insomnia due to the excitation of the sympathetic nervous system and cause sleep disorders due to sleep apnea. There is also insomnia caused by mental illnesses such as depression. These specific sleep disorders have treatments related to their underlying causes and they cannot be cured by ordinary sleeping drugs.

The first step in treating chronic insomnia is to review the patient's sleep habits and coping strategies. This is a non-pharmacological treatment. The most commonly used treatment is sleep drugs (pharmacotherapy). There are several types of drugs: those that stimulate the functioning of the brain's inhibitory system, those that help the action of sleep-related hormones in the brain, and those that suppress the functioning of the brain's waking system.

The first step is to review sleeping patterns and behaviors before using sleeping drugs. After that, sleeping drugs are used as an assistant for a short period.

問 1

睡眠における下線部(1)と(2)の状態のうち、日中の身体的疲労が蓄積している時に増えてくるのはどちらか？

Which of the underlined (1) and (2) states is increased by sleep when physical stress accumulates during the day?

問 2

この文章はどの様な病気について説明しているものか？

英語または日本語で、1-2 行以内で説明しなさい。

What kind of disease is this text describing?

In English or Japanese, explain in 1-2 line(s) or less.

問 3

この病気で、高齢の患者に多くみられる症状（タイプ、カテゴリー）は何か？

英語または日本語で答えなさい。

What is the most common symptom (type of insomnia category) of this disease in aged patients?

Please answer in English or Japanese.

問 4

下線部(a)と(b)の文章を和訳しなさい。

Translate the underlined sentences (a) and (b) into Japanese.

問 5

この病気の原因はどういったことが挙げられるのか？
英語または日本語で数行（5〜10 行）程度で要約して説明しなさい。
What are some reasons for this disease?
Please summarize and explain explain in a few (5-10) lines or less, in English or Japanese.

問 6

次の文章を英訳しなさい。
Translate the following sentences into English.

「睡眠時無呼吸症候群は、眠っている間に、呼吸が一時的に止まってしまう病気である。呼吸が止まると血液中の酸素濃度が低下するため、起きてしまう（目を覚ます）。これを一晩中繰り返すため、深い睡眠が出来なくなる。」

睡眠時無呼吸症候群 : sleep apnea syndrome
呼吸 : respiration、breath

問題２　以下の文章を読んで、以下の問いに答えなさい。

(I) A deeper understanding of the molecular and cellular underpinnings of metastatic disease and a renewed focus on metastasis-targeting therapeutic approaches raise hopes for improved clinical translation.

(II) That metastasis is the leading cause of cancer-related death sadly remains a truism in the cancer field. Despite the fact that outcomes for patients with cancer have improved dramatically over the past few decades, with cancer-related mortality in the United States alone dropping by 29% since the early 1990s, survival rates for patients with metastatic disease remain dismal. A prime reason for the limited clinical progress is that metastasis is a systemic, multi-step process, with context-dependent features ascribed to each particular tumor type, the colonized organ and its microenvironment.

(III) Layered over this complexity is the lengthy time to the development of detectable metastatic disease, which has proven a formidable foe in the efforts to tackle metastasis. Few of the many cancer cells that leave the primary tumor will eventually initiate metastatic outgrowth in distal sites, and the manifestation of metastasis typically occurs after long periods — on the order of several months to years — of undetectable disease after treatment of the primary tumor. A major factor in this is tumor dormancy: the ability of disseminated tumor cells (DTCs) to enter a prolonged state of growth arrest until conditions governed by their microenvironment reactivate them to fuel metastatic outgrowth. Understanding the biology that underlies the initiation of and awakening from dormancy is key in the efforts to improve outcomes for patients with cancer.

(IV) Building on the literature that identified the extracellular matrix (ECM) as an important microenvironmental component of the metastatic niche, Di Martino et al. study the interplay between DTCs and their surrounding ECM in controlling tumor dormancy. Using established head-and-neck and breast cancer cell line models of dormancy and sophisticated imaging methods, the authors define the collagen architecture of dormant tumor nodules and individual cells versus that of their proliferating counterparts, and observe that remodeling of collagen fibers to a more linear orientation is linked to the reactivation of DTCs from dormancy. Defining the matrisome of dormant cancer cells versus that of proliferative cancer cells and characterizing its functional importance in mouse tumor-implantation experiments in vivo, they show that dormant cancer cells produce an ECM rich in type III collagen, which endows such microenvironments with a wavy ECM organization and the ability to induce and maintain dormancy. They further demonstrate that expression of type III collagen and establishment of this dormancy phenotype requires signaling through the collagen receptor DDR1 and transcription factor STAT1. Although more work is needed to pave a route to clinical translation, these findings raise the intriguing possibility of detecting metastatic recurrence through altered ECM architecture and of using type III collagen and ECM remodeling therapeutically to suppress metastatic tumor outgrowth by reinforcing a dormant state on tumor cells.

dormancy:休眠状態、disseminated:播種した

問 1
(II) の下線の部分を和訳しなさい。

問 2
(III) の下線の部分を和訳しなさい。

問 3
(IV)ではどの様な実験が行われて、何がわかったか。日本語で説明しなさい。

問 4
何を理解することが、転移性のがん患者の生存率を上げるために重要か、英語で答えなさい。

問 5
この文章の題名を英語でつけなさい。

問題 3
各自が博士課程で行う研究について、英文で述べなさい(回答用紙の 10 行以内)。